

**Time: Friday, April 28, 2023 at 1:30 PM**  
**Location: Fluor Daniel EIB 132**

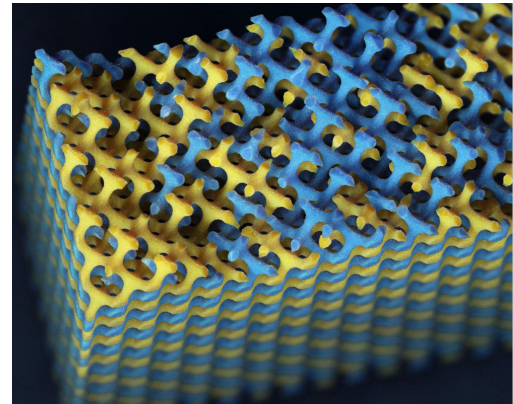
## **Engineering with Air: Frontiers in Structural Metamaterials**

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### **Abstract:**

Structural metamaterials, also known as lattice-, truss-, architected-, or programmable-materials, possess unique mechanical properties as a result of their designed topology. While structural metamaterials in the form of honeycomb or foam have been in use for decades, additive manufacturing has greatly accelerated opportunities in this design space. The traditional metrics for these materials have been strength-to-weight and stiffness-to-weight; however, as the design space opens it is possible to envision a broader palette of multifunctional architectures to manage various mechanical, thermal, electrical, and chemical challenges simultaneously. In this presentation, we describe novel Sandia topologies for controlling the transfer and dissipation of energy. To optimize metamaterial architectures, we will discuss efficient computational methods for nonlinear and multifunctional design. Finally, we illustrate the important role of manufacturing-induced defects, such as surface roughness and porosity, that are often ignored in design but can dominate product qualification. Machine learning methods provide potential new pathways to overcome challenges from process-aware optimization to product qualification.



### **Biosketch:**

Dr. Boyce is a Distinguished Member of the Technical Staff at Sandia National Laboratories. Dr. Boyce received the B.S. degree from Michigan Tech in Metallurgical Engineering and the M.S. and Ph.D. degrees from the University of California at Berkeley. Dr. Boyce joined the technical staff at Sandia in 2001 where his research interests lie in micromechanisms of deformation and failure. He has published over 160 peer reviewed articles on topics such as microsystems reliability, nanoindentation, fracture in structural alloys, weld metallurgy, and fatigue mechanisms. Dr. Boyce is a recipient of the Hertz fellowship and the J. Keith Brinacombe Medal. He is also vice president of TMS, The Minerals, Metals, and Materials society.